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Prober Control Software 2.1 User Guide

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Prober Control Software 106-908-C

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Manual Updates

This manual was rewritten 6/96 to reflect a new software release. The information in this manual is subject to change without notice. See the file **cascade/readme.txt** for more information about new software features.

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ABOUT THIS GUIDE

Welcome to the *Prober Control Software (PCS) User Guide*. This guide provides information about the Cascade Microtech software for controlling semi-automatic probe stations.

Organization

For detailed information about using PCS, please refer to online help.

This user guide contains the following chapters:

1. Starting Out	Gives an overview of PCS, including information about system requirements, technical support, online help, and basic information about the application.
2. Using PCS	Gives the core procedures on how to use PCS to control your probe station.
3. Using Probe Plans	Gives procedures for executing probe plans, including how to single-step through them. Also, explains how to use a test program in conjunction with the probe plan.

Related Information

Cascade Microtech provides information in printed form, on video tape, and through online help. For more information about using probe stations, refer to the following:

- *Probe Plan Editor User Guide.* Explains how to use the Probe Plan Editor software to create and modify probe-plan files.
- *Probe Station Communications Guide.* Discusses controlling probe stations with a Dynamic Data Exchange (DDE) application program, from a remote host over the General Purpose Interface Bus (GPIB), or through the PCS Command Interface.
- Hardware guide for your probe station. Contains installation and troubleshooting procedures.

- Installation video tape for your probe station. Provides a step-by-step demonstration of installing the probe station.
- *WinCal User Guide.* Contains information about Cascade's software for calibrating vector network analyzers.
- *PCS Online Help.* Online help is available in all Cascade applications that run under Windows.
- *Calibrations and Accuracy Factors.* Describes and discusses the advantages and disadvantages of various calibration strategies.
- Visual Basic Examples. Using the Visual Basic programming language, it is possible to automate many different types of measurements. To aid you in this, Cascade provides a number of Visual Basic test programs that you can modify to meet your custom testing needs. These programs are included with your PCS installation software.

Introduction

This chapter contains the following information about Cascade Microtech's Prober Control Software (PCS):

- User Interface
- System requirements
- Technical support
- About PCS
- Starting PCS
- Using on-line help

User Interface

PCS is a Microsoft Windows application. If you are familiar with navigating and using a mouse in Windows, you will be able to use PCS. If you are unfamiliar with Windows, please see your Microsoft Windows documentation.

System Requirements

PCS works with the following *minimum* system requirements:

- A 386 IBM-compatible computer with a standard AT-bus
- DOS Version 6.0 or later
- Windows Version 3.1 or later
- Mouse
- 4 MB RAM
- Color SVGA monitor
- One high-density, 3.5-in. floppy disk drive

- One hard disk drive with approximately 5 MB available disk space

Technical Support

Call (503) 626-8245 and ask for customer service.

If you need technical support for PCS, please read everything relevant to the problem in the **Cascade readme.txt** file, this user guide, and the on-line help before calling customer service.

Note

The **readme.txt** file often contains information about the software release that is not contained in manuals or on-line help. Be sure to read this file before calling technical support.

To receive a faster solution, try to re-create the problem to provide us with an exact sequence of events. Please have the following information available, if possible:

1. Name, version number, and file date of the application in use.
2. Disk drive information, including sizes, hard drive controller card brand, partition sizes, and partitioning software.
3. Additional hardware such as specialty video cards, EMS boards, or turbo cards.
4. Memory-resident programs in use when the problem occurred. Problems can occur when memory-resident programs are not loaded in the correct order.

Please Review your AUTOEXEC.BAT file.

5. Contents of your **AUTOEXEC.BAT** and **CONFIG.SYS** files.
6. Exact wording of any error messages.
7. Notes about any steps you took in trying to solve the problem, and their outcome.
8. DOS version, including manufacturer.

About PCS

The Prober Control Software (PCS) application lets you control the Cascade Microtech semi-automatic probe stations from the probe station's computer (an IBM-compatible PC with some specialized boards installed). Through PCS, you can:

- move the stage to any position
- raise and lower the chuck
- control chuck vacuum

- save and restore configuration settings
- load and run probe plans
- turn the microscope light on and off
- turn auxiliary power on and off
- calculate compensation factors
- align your DUT with the station
- change the mode of operation
- launch other Cascade applications

Starting PCS

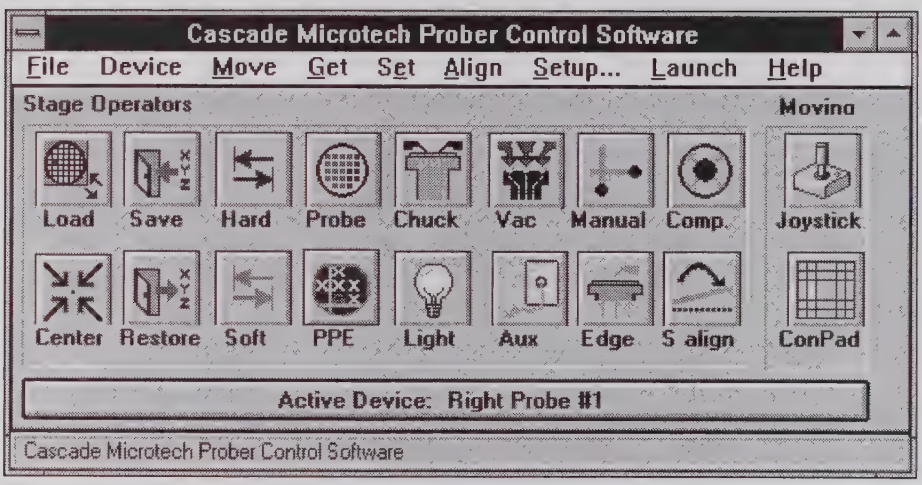
The PCS icon is created in a default Cascade group on your Windows desktop.

Caution

When you start PCS, the stage will move and the chuck will rise automatically. Make sure that the stage is free to move and that the probe height is set so that the chuck will not crash into the probe tips.

From the desktop, double-click the PCS icon to open the PCS window and the Probe Station Status window.

Overview of PCS Window


Cascade Microtech Prober Control Software
File Device Move Get Set Align Setup... Launch Help
Stage Operators
Moving
Load Save Hard Probe Chuck Vac Manual Comp. Joystick
Center Restore Soft PPE Light Aux Edge S align ConPad
Active Device: Right Probe #1
Cascade Microtech Prober Control Software

PCS Menus

CHOOSE THIS MENU	TO DO THE FOLLOWING
File	Load and save station configurations, or exit PCS
Device	Activate a device (either the station or a probe)
Move	Move the active device (starred commands are those that move the active device) or open a probe plan
Get	Retrieve information
Set	Move commands (starred) move the active device. Other commands set mode, parameters
Align	Perform a software or hardware alignment
Setup	Opens Setup dialog box
Launch	Launch another PCS software application
Help	Get help

Stage Operators (Buttons)

The Stage Operators are as follows. These buttons affect the station stage only.

CLICK THIS BUTTON	TO DO THIS
	Move the x-y stage to the load position.
	Move the stage to the center.
	Saves the current stage position. Note: The saved position includes the x-axis, y-axis, and chuck height positions.
	Moves the stage back to the last saved position.
	Align (via the hardware) the DUT to the probe station's x- and y-axes.
	Align (via the software) the DUT to the probe station's x- and y-axes.
	Open the Probe Plan dialog box
	Open the Probe Plan Editor
	Move the chuck up or down.
	Turn the microscope light on or off.

CLICK THIS BUTTON	TO DO THIS
	Turn the chuck vacuum on or off.
	Turn the auxiliary power on or off.
	Put the station in Manual mode
	Turn on or off Edge Sensing
	Turn Compensation mode on and off. Corrects distance measurements for thermal expansion with the compensation factor.
	Turn on or off Software Alignment

Moving Buttons

The Moving buttons are as follows. By default, these applications control the station stage. Once you launch them, you can also configure them to control a probe from their respective Setup window.

CLICK THIS BUTTON	TO LAUNCH THIS APPLICATION
	Launch the Joystick
	Launch the Control Pad

Active Device Button Bar:

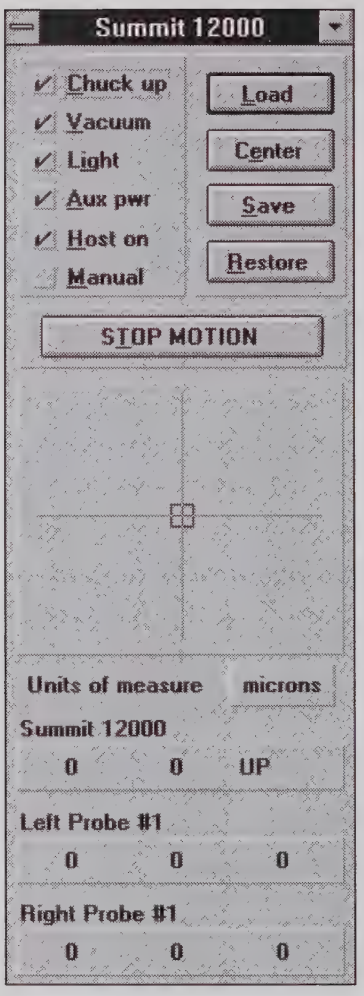
Click this bar to activate the station or the probes. The active device can be controlled only by menu commands with a star next to them.

You can also activate a device from the **Device** menu.

Overview of Status Window

*Click **STOP MOTION** to instantly halt all stage and chuck movement.*

The Probe Station Status window identifies the model of probe station you have, displays the stage, chuck, and probe positions, and contains check boxes to show you the probe-station setup. The check boxes also provide short-cuts for performing some of the most frequently-used functions in the PCS window.



Arranging Windows

When working with PCS, arrange the screen so you can see these windows:

- PCS
- Control Pad or Joystick, whichever you like to use
- Status

To Force the PCS Window to Stay on Top of Other Windows:

1. Click **Setup**. PCS displays the **Options** dialog box.
2. Check **Always on top**.
3. Click **OK**.

Using On-line Help

PCS provides extensive on-line help. This help system works the same as all Windows help. If you need more information about using Windows help, see also your Windows documentation.

The PCS help system supplements this user guide by providing information such as a glossary of terms and in-depth explanations of selected topics.

The Help Menu

To access on-line help, click Help in the PCS menu bar. The PCS Help menu contains these commands:

CHOOSE	TO DO THIS
Contents	View the table of contents for PCS. To view help for a particular topic, click the underlined word or phrase.
Function keys	View a list of function keys for PCS.
Search	Search for help on a specific topic. Type a topic in the text box and press Enter or choose Show Topics. A list of possible help topics appears. To view help for a particular topic, select the topic you want and choose Go To.
Help using help	Learn more about using the Microsoft Windows help system. To view help for a particular topic, click the word or phrase.
About ...	View information about PCS. The window that appears displays the application name, version number, and copyright date.

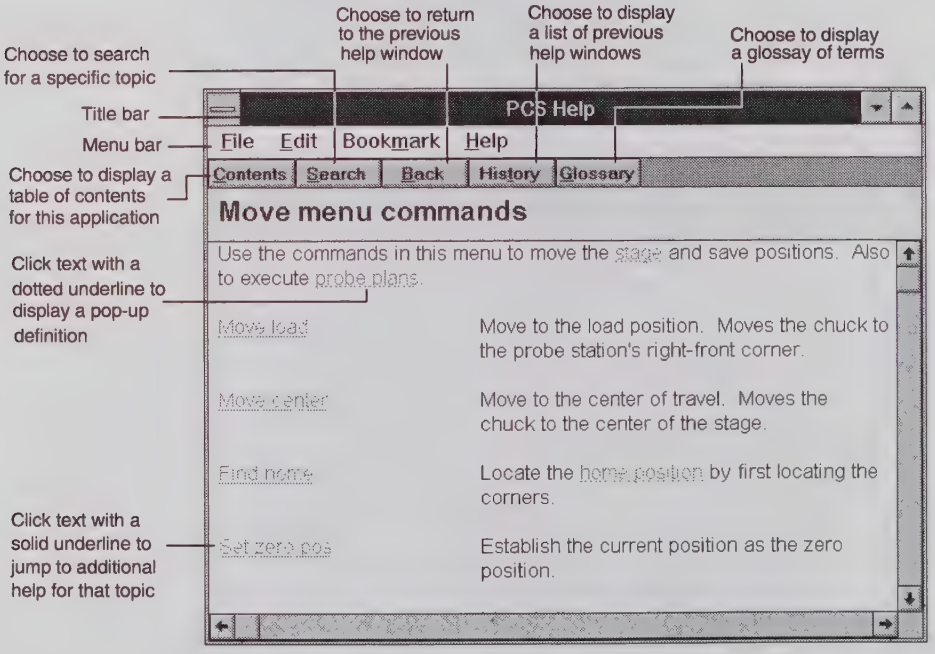
Context-Sensitive Help

In all dialog boxes, you can click the **Help** button to view information specifically for that dialog box.

The Help Window

Throughout the help system, you can click any word with a solid underline to go directly to a help screen for that topic. Or, you can click a word or phrase with a dotted underline to see pop-up help for that topic or term.

The following sample help window illustrates the features of the on-line help system:


Choose to search for a specific topic
Choose to return to the previous help window
Choose to display a list of previous help windows
Choose to display a glossay of terms
Title bar
Menu bar
Choose to display a table of contents for this application
Click text with a dotted underline to display a pop-up definition
Click text with a solid underline to jump to additional help for that topic
PCS Help
File Edit Bookmark Help
Contents Search Back History Glossary
Move menu commands
Use the commands in this menu to move the stage and save positions. Also to execute probe plans.
Move load
Move to the load position. Moves the chuck to the probe station's right-front corner.
Move center
Move to the center of travel. Moves the chuck to the center of the stage.
Find home
Locate the home position by first locating the corners.
Set zero pos
Establish the current position as the zero position.

Introduction

In this chapter, read about:

- Main steps for using PCS
- Setting up the probe station
- Moving the stage
- Controlling the chuck
- Loading DUTs
- Aligning DUTs
- Launching other applications

Main Steps for Using PCS

This table shows the main steps for using PCS to make measurements. Look for details about how to perform each step later in this chapter.

STEP	WHAT YOU DO
1	Set up the probe station parameters such as the operating mode, what information to display, whether to use a compensation factor, and so on.
2	Turn on the microscope light.
3	Load the DUT onto the chuck.
4	Align the DUT to the probe-station axes by adjusting theta.
5	Adjust the probe-to-DUT contact and set overtravel. See your probe and positioner documentation for details.
6	Load the probe plan, if you are using one.
7	Move the stage to the measurement site.
8	Raise the chuck and lower the platen.
9	Make your measurement.

Setting Up the Probe Station

In PCS, there are many ways to set up the probe station.

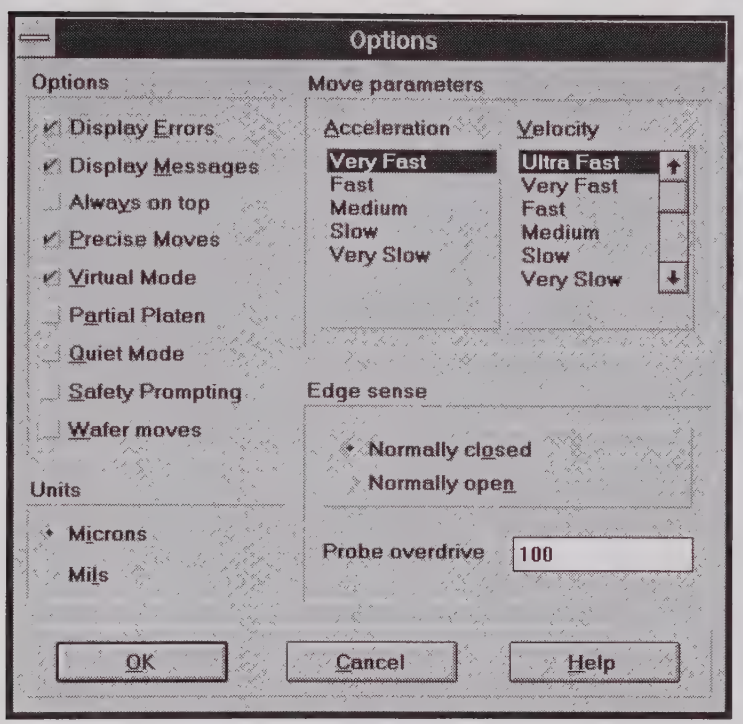
Setting up the probe station involves:

- Turning on or off the microscope light
- Enabling auxiliary power outlets
- Locking out other applications that control the probe station, if necessary
- Setting up the data display to suit your application
- Calculating compensation factors, if necessary
- Choosing your mode of operation
- Setting acceleration and velocity for stage moves
- Turning edge sensing on or off

*Click **Setup**.*

While PCS provides multiple ways of changing the probe-station setup, you can use the **Options** dialog box to define most of your setup all at once.

Click **Setup** in the PCS menu bar to open the **Options** dialog box.



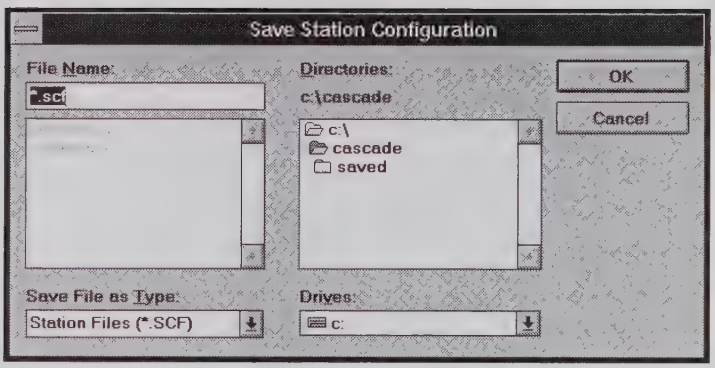
Saving and Restoring Your Setup

Once you are happy with how your probe station is set up, you can save the setup to a file for later use. Saving and restoring the setup works the same way in PCS as in most other MS Windows applications.

To Save the Setup:

*Setup files are given the **.scf** extension.*

1. Choose **Save config as** from the File menu. The window displays the **Save Station Configuration** dialog box.



2. Enter the file name you want to save probe-station settings in. Make sure the drive and directory path are correct.
3. Click **OK**.

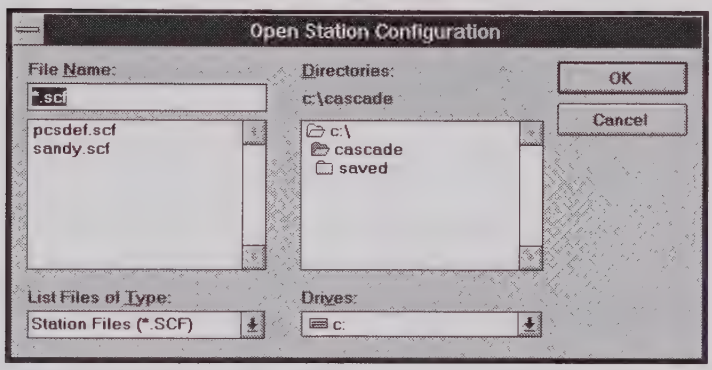
When the probe station first starts up, it loads setup data from the last PCS session, which is stored in the **pcsdef.scf** file.

To Update the Default Setup File with New Settings:

1. Change the settings in PCS.
2. Select **Save default config** from the File menu. PCS overwrites the existing defaults file with the new probe station settings.

To Restore Settings From a Setup File:

1. Select **Load configuration** from the File menu. You see the Open Station Configuration dialog box.



2. From the **List Files of Type** drop-down list, select ***.SCF**.
3. Select the drive, directory, and file name of the setup file.
4. Click **OK**. PCS downloads the setup information from the file to the probe station.

To Restore Factory Default Settings:

1. Select **Set to factory defaults** from the File menu.
2. Click **OK**. PCS restores the original settings.

Note

Factory defaults returns stored numeric values to zero, returns labels to the default names, and so forth. However, it does not change any of the selections you've made in the Set Options dialog box.

To Turn On/Off the Microscope Light

Light

⇒ Click the **Light** button in the PCS window.
-or-
Choose **Light** from the Set menu.
-or-
Check the **Light** box in the Status window.
-or-
Press **F9**.

The **Light** button is yellow when the microscope light is on and is dimmed when the light is off.

To Turn On/Off Auxiliary Power

If your probe station has auxiliary power outlets, you can turn the power to them on or off. This enables you to use software to turn on other instruments.

On

Off

⇒ Click the **Aux** button in the PCS window.
-or-
Check the **Aux pwr** box in the Status window.
-or-
Choose **Aux Power** from the Set menu.

To Lock Out Other Users

When the probe station is locked, it ignores commands from other users or applications. This ensures that you control the probe-station hardware.

⇒ Choose **Hardware Lock** from the Set menu.

To Display or Disable Messages

By default, PCS displays all messages in a message box. You can turn on or off the display of error and information messages:

Caution

Be careful when moving the stage with messages and errors turned off. It's easier to accidentally crash the probe tips into the DUT when no warnings are being given.

1. Click **Setup**. PCS displays the Options dialog box.
2. If you want to display informational messages, check the **Display Messages** box . Uncheck the box if you don't want to see messages.
3. If you want to display error messages, check the **Display Errors** box . Uncheck the box if you don't want to see errors.
4. If you always want to display the PCS window on top of all the other windows, check the **Always on top** box.
5. Click **OK**.

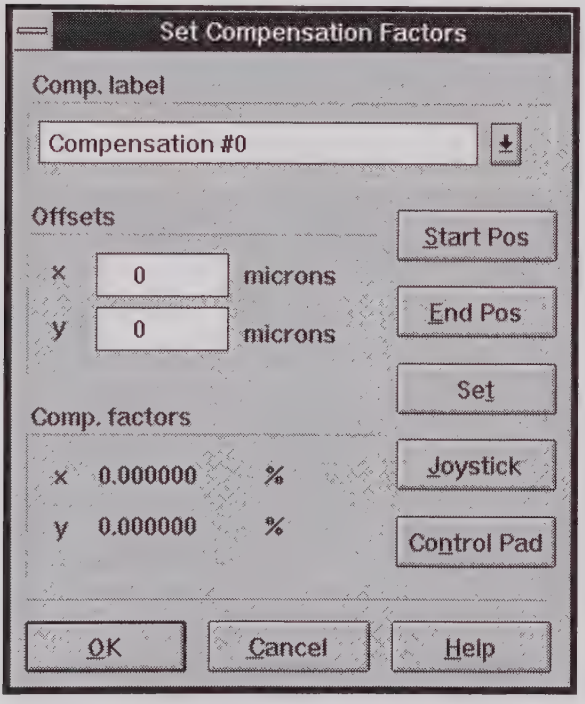
Using Compensation Factors

To compensate for thermal expansion or other position errors, stage-movement distances can be multiplied by a *compensation factor*. PCS determines compensation factors by calculating the percentage of error

between the nominal distance and the actual distance. Using PCS, you can calculate and store multiple compensation factors.

To calculate and set compensation factors:

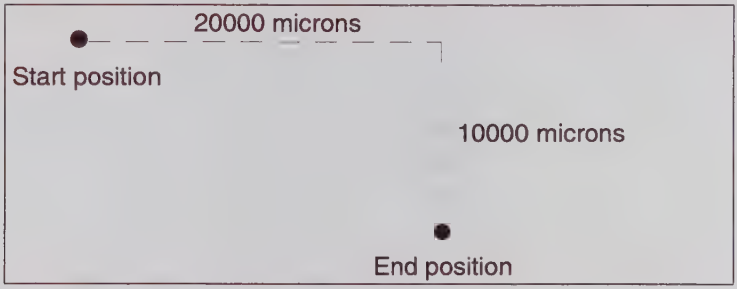
1. Choose **Compensation values** from the Set menu. PCS displays the Set Compensation Factors dialog box.



2. Under **Comp. label**, select a name for the compensation factor. You can change a name by highlighting it, then typing over it with the new name.
3. Under **Offsets**, enter the nominal distances along the x- and y-axes between the starting and ending positions.

Example

If you had the geometry shown as the Compensation Factor Example, enter 20000 in the **x** box and 10000 in the **y** box.



Compensation Factor Example

4. If not already running, click either the **Control Pad** or **Joystick** buttons to launch one of these applications for moving the stage.
5. Move the stage to the start position, then click **Start pos.**
6. Move the stage to the end position, then click **End pos.** As soon as you click **End pos**, PCS calculates the compensation factor and assigns it to the current label, deleting the previous factor assigned to that label.

Note

Calculate another compensation factor by repeating steps 2 through 6, or download the compensation factor saved in step 5 to the hardware driver by performing steps 7 and 8.

Whenever you turn on compensation, the probe station uses the most recently set compensation factor.

7. To activate a compensation factor, select its label in the **Comp. label** box, then click **Set**.
8. Click **OK**.

To turn compensation on or off:

Comp.

⇒ Click the **Comp.** button in the PCS window.
-or-
Choose **Compensation mode** from the Set menu.

The **Comp.** button is red and blue when Compensation mode is on and dimmed when it is off.

To Operate in Quiet Mode

Quiet mode does not operate if you are moving the stage with the Joystick or Control Pad.

Normally, the probe-station motors are on all the time. However, if you need to reduce electrical interference during your measurements, you can operate the probe station in quiet mode. In quiet mode, the motors are on only during stage movements and are off the rest of the time.

1. Click **Setup** to display the Options dialog box.
2. Check the **Quiet Mode** box.
3. Click **OK**.

To Operate in Virtual Mode

Virtual Mode allows you to run PCS on a computer that does not have any probe-station hardware connected to it:

1. Click **Setup** to display the Options dialog box.
2. Check the **Virtual Mode** box.
3. Click **OK**.

Moving the Stage

Caution

Make sure you adjust the probe-to-DUT contact before moving the stage with the chuck up. If you crash the probes into the chuck, you can damage the probes and your DUT. Refer to your probe documentation for instructions.

The probe station stage *is the moveable platform that supports the wafer chuck.*

PCS uses the same stage-movement parameters regardless of how you move the stage.

You can move the stage in the following ways:

- Move the stage to absolute coordinates.
- Define a user zero location and make moves relative to that location.
- Use software buttons to move the stage to frequently-used locations, such as the load position.

*To set acceleration and velocity, click **Setup** in the PCS window.*

- Use the Control Pad or Joystick applications to move the stage interactively.
- Save a position and return to it later.
- Move to sites defined by a probe plan. Refer to *Chapter 3, Using Probe Plans*.

- Switch to Manual mode and use the probe station's manual controls to move the stage. Refer to your probe station user guide for the locations of the manual controls.

To Set Stage Movement Parameters

Stage movement parameters control how the stage moves. For example, the velocity, the acceleration, and the units of measure you use to specify a location:

1. Click **Setup** to display the Options dialog box .
2. Select an acceleration.
3. Select a velocity.
4. Select either **Microns** or **Mils** under **Units**. The unit determines whether stage-movement distances are displayed and entered in English or Metric units.

Precise moves are slightly slower than standard moves.

5. (Optional) Check **Precise Moves** if you require your stage movements to be especially accurate. This causes PCS to correct the stage position every time the chuck is raised or lowered.
6. (Optional) Check **Safety Prompting** to confirm stage movements before they occur. By confirming stage movements, you can avoid accidental damage to a probe or wafer.
7. (Optional) Check **Partial Platen** to enable the stage to move if the platen is only partially up. If **Partial Platen** is not checked, you can move the stage only if the platen is fully up.
8. (Optional, for 12000 series only) Check **Wafer moves** if you are probing flat wafers rather than modules. This setting causes the chuck to drop only part way before the stage starts moving, resulting in faster moves. If **Wafer moves** is not checked, the stage does not move until the chuck is completely lowered.
9. Click **OK**.

To Set the User Origin

You can set the origin (coordinate location 0,0) to be at any point on the your DUT:

1. Move the stage to the location you want to define as the user origin.
2. Choose **Zero position** from the Set menu.

To Move to the User Origin

⇒ Choose **Move zero pos** from the Move menu.

To Move to Absolute Coordinates

The absolute coordinate system references stage movements from the user origin. Coordinates are offsets from the origin.

1. Choose **Absolute/relative moves** from the Move menu to display the Move Device dialog box.
2. Under **Mode**, check **Absolute**.
3. Under **Chuck position**, check **Up** or **Down**. PCS lowers the chuck before moving the stage. Check **Up** to raise the chuck automatically when the stage reaches the new location. Check **Down** to leave the chuck lowered.

Note

If you have a probe station with a motorized (rather than pneumatic) chuck, you also have the option of entering a z-axis height instead of checking Up or Down.

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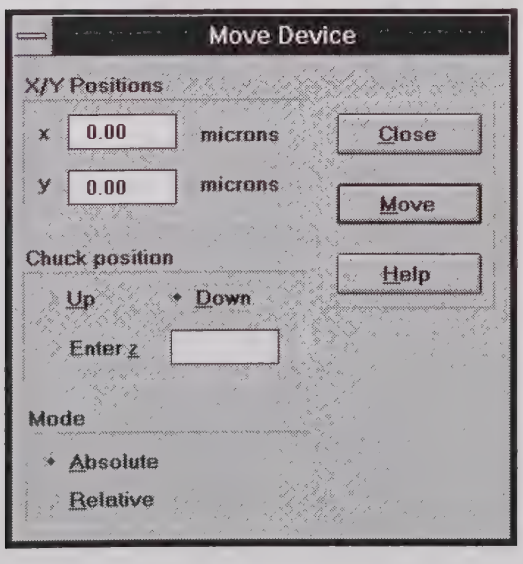
4. Under **X/Y Positions**, enter the **x**- and **y**-axis coordinates.
5. When you are ready for the stage to move, click the **Move** button. The stage moves to the location you set.



To Move Relative to the Current Location

You can move the stage to coordinates measured from the current location:

1. Choose **Absolute/relative moves** from the Move menu to display the Move Device dialog box.
2. Under **Positions** in the Move Device dialog box, enter the desired **x**- and **y**-axis offsets from the current location.
3. When you are ready for the stage to move, click the **Move** button. The stage moves to the new position.

To Find and Move to the Home Position

Home *is the center of the probing area.*

⇒ Choose **Find home** from the Move menu.

The probe station locates the home position by moving the stage to the end of the (travel) limit switches at the left-rear of the probe station, then moves the stage back to the center.

To Center the Stage

You can move the stage to the center of the probing area by doing one of the following. PCS lowers the chuck and moves the stage.

Center

⇒ Click the **Center** button in the PCS window
-or-
Choose **Move** center from the Move menu
-or-
Check the **Center** button in the Status window
-or-
Press **F8**

To Move to the Load Position

The *load position* depends on the model of the probe station. For the Summit 10000 series, it is the right, front corner. For the Summit 12000 series, it is the front center.

Load

Refer to Loading Devices *later in this chapter.*

⇒ Click the **Load** button in the PCS window
-or-
Choose **Move load** from the Move menu
-or-
Press **F7**
-or-
Click the **Load** button in the Status window

To Scan

Hard

1. Click the **Hard** button in the PCS window to open the Align Device dialog box.
2. Click the **Align** button in the Align Device dialog box. to start the stage *scanning* (moving back and forth across a defined distance).

Refer to *Aligning DUTs*, later in this chapter, for instructions on setting scan parameters and adjusting theta.

Saving and Moving to Saved Positions

There are three ways of saving a position so that you can quickly return the stage to it:

1. You can save a single position.
2. You can save the position under a label in the Save/Restore Positions dialog box.
3. You can store the position's x- and y-axis coordinates in the Move Device dialog box's drop-down list.

To Save a Single Stage Position:

1. Move the stage to the desired position.
2. Click the **Save** button
   -or-
   Choose **Save pos** from the Move menu
   -or-
   Press **F2**.

Save

To Return to the Saved Stage Position:

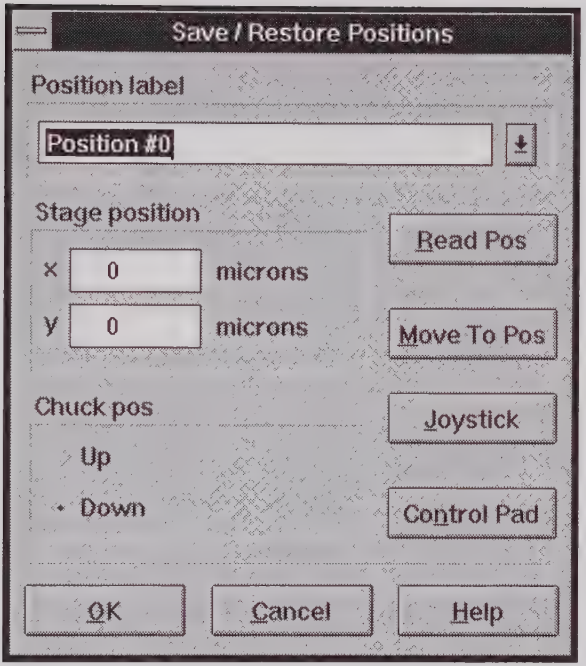
Restore

⇒ Click the **Restore** button
-or-
Choose **Move saved pos** from the Move menu
-or-
Press **Shift-F2**

To Save Stage Positions under Labels:

*Click **Joystick** or **Control Pad** to move the stage.*

1. Choose **Select pos** from the Move menu. PCS displays the **Save/Restore Positions** dialog box.
2. In the **Position label** box, select a label (name). You can change a label by selecting it and typing in a new label.
3. Enter the **x**- and **y**-axis coordinates of the position you want to save.
   -or-
   Move the stage to a desired position and click **Read pos**.
4. Click **Up** to raise the chuck when you move to the saved position or **Down** to leave the chuck down.
5. To save the position and close the dialog box, click **OK**
   -or-
   To save the position and leave the dialog box open, select a new **Position label** (step 2).
6. Repeat steps 2 - 5 for each position.



To Move to Labeled Positions:

1. Choose **Select pos** from the Move menu to open the Save/Restore Positions dialog box.
2. Select a label in the **Position label** box.
3. Click **Move to pos**. The stage moves to the saved position.

To Save Positions as Coordinates:

1. In the Move menu, choose **Absolute/relative moves.** PCS displays the Move Device dialog box.
2. Enter the x- and y-axis coordinates under **Positions**.
3. Click the arrows under **Position label** to scroll to a different entry in the drop-down list box.
4. Repeat steps 2 and 3 until you have saved all the desired coordinates.

To Return to Saved Coordinates:

1. In the Move menu, choose **Absolute/relative moves.** PCS displays the Move Device dialog box.

2. Click the arrows under **Positions** to select the desired x- and y-axis coordinates.
3. Click **Move** to move the stage to the coordinates.

To Move the Stage with the Mouse and Control Pad

Refer to on-line Help in the Control Pad application for more information.

ConPad

You can use a mouse to move the stage from the Control Pad software. Launch the Control Pad to display a control pad of 24 tiles. Click a tile to move the stage. You can set the velocity for each tile.

⇒ Choose **Control pad** from the **Launch** menu.
-or-
Double-click the Control Pad icon in the Cascade program group.
-or-
Click the ConPad button in the PCS window.

Additionally, some of the dialog boxes have **Control Pad** buttons which will launch the software.

To Move the Stage with the Joystick

Refer to on-line Help in the Joystick application for more information.

Joystick

The joystick is an optional accessory for moving the stage. The joystick software activates the joystick and enables you to program the joystick's stage-movement parameters.

⇒ Choose **Joystick** from the Launch menu.
-or-
Click the **Joystick** button the PCS window.
-or-
Double-click the **Joystick** icon in the Cascade program group.

Additionally, some of the dialog boxes have **Joystick** buttons which will launch the software.

To Undo a Move

⇒ Select **Undo last move** from the Move menu.

Note

You cannot undo a move made with the Joystick or Control Pad.

To Move the Stage with Manual Controls

The Joystick and Control Pad do not work in manual mode.

Always put PCS in manual mode before using the x- and y-axis knobs on the probe station to move the stage. In manual mode, PCS tracks the stage movements and the Status window displays the current stage location.

To Toggle On/Off Manual Mode:

Manual

See your probe station user guide for descriptions and locations of manual controls.

1. Click the **Manual** button in the PCS window.
   -or-
   Choose **Manual mode** from the Set menu.
   -or-
   Check the **Manual** box in the Status window.
   -or-
   Press **F11**.
2. Use the probe station's manual controls to move the stage.

Manual button is colored when Manual mode is on and is dimmed when it is off.

Note

When you exit Manual mode, the motors move slightly.

Controlling the Chuck

The top of the wafer chuck is the surface on which you place your device for testing. The chuck contains vacuum holes for holding your DUT in place. With PCS, you can control the height of the chuck and turn chuck vacuum on or off.

To Raise and Lower the Chuck

Caution

Make sure you adjust the probe-to-DUT contact before raising the chuck or moving the stage with the chuck up. If you crash the probes into the chuck, you can damage the probes and your DUT. Refer to your probe documentation for instructions.

Use one of the following methods to raise or lower the chuck. The appearance of the Chuck button changes to indicate whether the chuck is up or down.

Chuck lowered

Chuck raised

⇒ Click the **Chuck** button in the PCS window.
-or-
Check the **Chuck up** box in the Status window.
-or-
Choose **Chuck up**, **Chuck down**, or **Chuck toggle** from the Set menu.
-or-
Press **F12**.

Using Edge Sensing to Control Chuck Height

An edge-sense probe contains a switch that opens or closes when the probe tip contacts the DUT. This enables PCS to raise the chuck to the optimal probing height.

To Set Edge Sense Parameters

1. Click **Setup** in the PCS window to open the **Options** dialog box.
2. Check either **Normally closed** or **Normally open**, whichever matches your probes' non-contact switch position.
3. In the **Probe overdrive** box, enter the number of microns you want the chuck to raise after contacting the probe tip.
4. Click **OK** to apply the changes and close the dialog box. This does not turn on edge sensing.

To Turn On/Off Edge Sensing

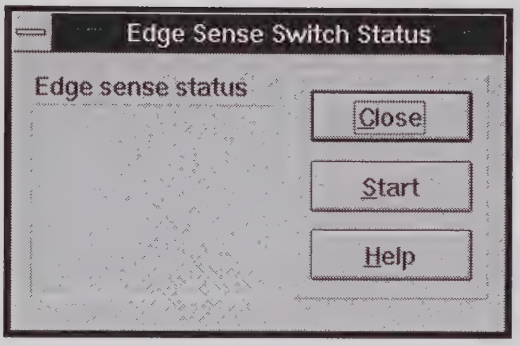
Edge

⇒ Click the **Edge Sense** button in the PCS Window.
-or-
Choose **Edge sense mode** from the Set menu.

The **Edge** button is colored when Edge Sensing mode is on and is dimmed when it is off.

To View Edge Sense Status

1. Choose **Edge sense status** from the Get menu. PCS displays the Edge Sense Switch Status dialog box.
2. Click **Start** to begin sensing whether or not the edge sense probe is making contact. The dialog box displays the status.
3. Click **Stop** when you are finished.
4. Click **Close** to close the dialog box.



To Toggle On/Off Chuck Vacuum

Vacuum On

Vacuum Off

⇒ Click the **Vac** button in the PCS window.
-or-
Check the **Vacuum** box in the Status window.
- or -
Choose **Vacuum** from the Set menu.
- or -
Press **F10**.

NOTE

Turning on chuck vacuum does not affect vacuum used for vacuum-mounted probes, vacuum on the corners of square chucks, vacuum on auxiliary stages, or the diameter of the hold-down area. These controls are usually manual. Refer to you probe-station documentation.

To Load a Device to be Probed

A device-under-test (DUT) can be a wafer, module, contact substrate, or ISS. To load a DUT, do the following:

Load

1. Raise the platen.
2. Move the stage to the load position by clicking the **Load** button. In the load position, the chuck is down.
3. Turn off chuck vacuum.
4. Using wafer tweezers, place your DUT in the center of the chuck or, in the case of contact substrates and ISSs, on one of the chuck corners or auxiliary stages. Visually align the DUT to the stage.

5. Turn on chuck vacuum to hold the DUT in place.
6. (Optional) Click **Center** to move the stage to the center of the probing area.

Your DUT is now loaded and ready for alignment.

To Align DUTs

After loading your DUT, you will need to align it with the probe station's x- and y-axes. There are two ways to do this:

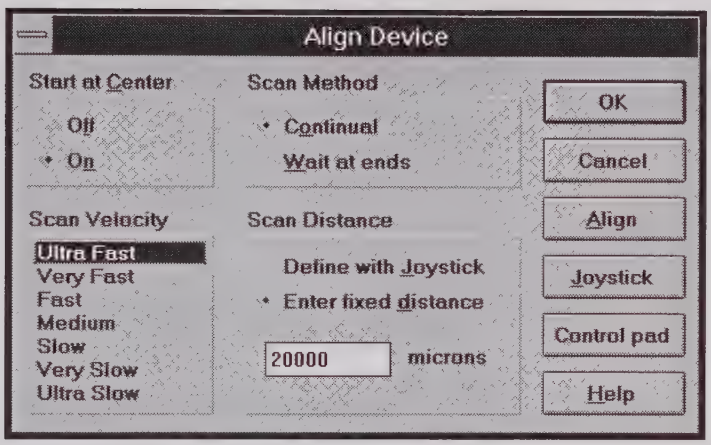
1. Hardware alignment (adjusting Theta): you rotate the chuck until the DUT is aligned.
2. Software alignment: PCS software adds offsets to stage movements to compensate for misalignment.

To Align the Hardware

1. Raise the platen.
2. Raise the chuck.
3. Select a feature on your DUT to use as a reference for alignment (or use the alignment die site in your probe plan). Move the stage so that you can see this feature through the microscope.

Hard

4. Click the **Hard** button in the PCS window
   - or -
   Choose **via Hardware** from the Align menu. PCS displays the Align Device dialog box.
5. Under **Start at Center**, click either **On** or **Off**. If you select **On**, the stage always starts scanning from the center position. If **Off**, scanning starts from the current stage position.



6. Select either **Continual** or **Wait at ends** as the scan method. **Continual** causes the stage to move until you stop it by clicking **Cancel**. **Wait at ends** causes the stage to stop at each end of the scan distance until you press a key.
7. Select the scan velocity.
8. Define the scan distance. There are two ways to do this. You can enter a fixed distance, or you can define the distance with the Joystick or Control Pad.

   To enter a fixed scan distance:

   a) Click **Enter fixed distance**.

   b) Enter the distance in the next field. The distance is measured in microns and is the distance between endpoints. The endpoints are always equidistant from the starting position.

   To define the scan distance with the Joystick or Control Pad:

   a) click **Define with Joystick**

   b) click either **Joystick** or **Control Pad**, whichever you want to use to move the stage

   c) click **Align**

   d) follow the prompts to set the endpoints
9. Click **Align** to start scanning.
10. View the DUT through the microscope and turn the Theta Adjustment knob on your probe station until the DUT is correctly aligned.

11. When you are finished, click **Cancel** to stop scanning.

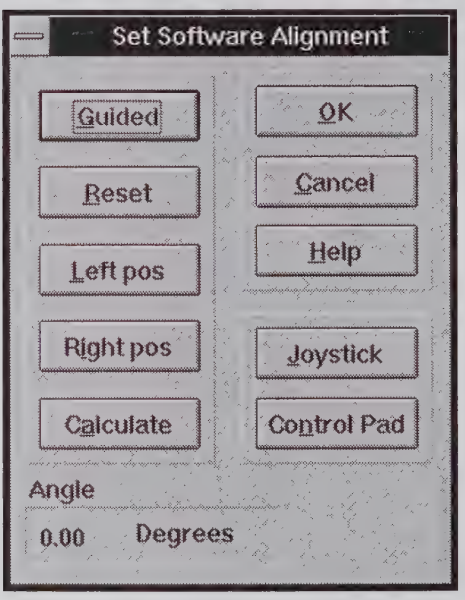
To Set Software Alignment Parameters

Note

Setting the parameters does not turn on Software Alignment mode.

Soft

1. Click the **Soft** button in the PCS window. PCS displays the Set Software Alignment dialog box.



If you want to be guided through these steps by message boxes, click the **Guided** *button.*

2. If not already running, click either the **Control Pad** button or the **Joystick** button, whichever you plan to use to move the stage.
3. Move the stage until you can see the alignment die through the microscope.
4. Move the stage to the left end of the alignment die.
5. Click the **Left Pos** button.
6. Move the stage to the right end of the alignment die.
7. Click the **Right Pos** button.

8. Click the **Calculate** button. The software calculates the angle the DUT is offset from the probe station's axes and displays it under Angle.

To Turn On/Off Software Alignment

S align

⇒ Click the **S Align** button
- or -
Choose **Soft align mode** from the Set menu.

The **S align** button is colored when Software Alignment mode is on and dimmed when it is off.

To Set Software Alignment to Zero

1. Click the **Soft** button to open the Set Software Alignment dialog box.
2. Click the **Reset** button.

To Launch Other Applications

Launching the Joystick and Control Pad was discussed earlier in this chapter.

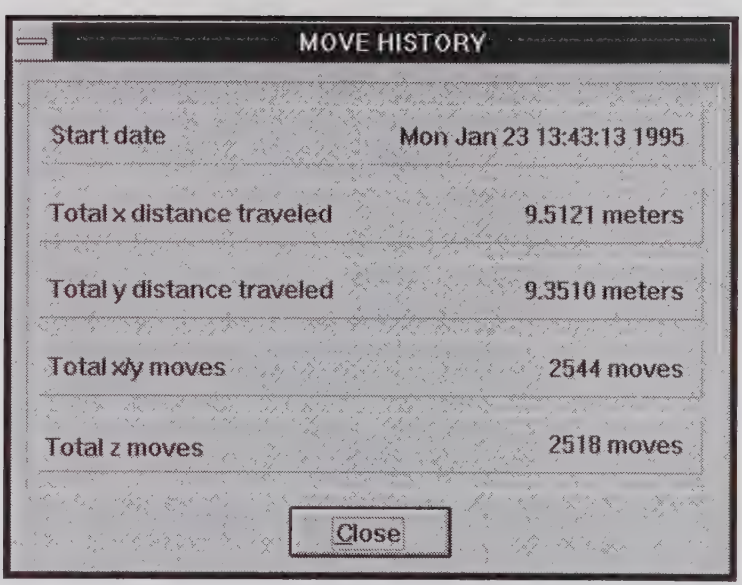
From PCS, you can launch other Cascade applications installed on your machine. For example, you can launch the DDE Server for communication with automated test programs, the GPIB Server for remote communication, or WinCal for calibrating your test system.

⇒ Select the application from the Launch menu. PCS continues to run along with the other application.

To View Stage Movement Statistics

PCS accumulates the number of moves and the total distance moved along each axis from when the probe station is placed in service.

⇒ Select **History** from the Get menu to open the Move History dialog box.



Measuring Distances on a DUT

You can use PCS to measure the distance between two points on a substrate. To increase the accuracy of your measurement, you can also take the average of up to ten measurements.

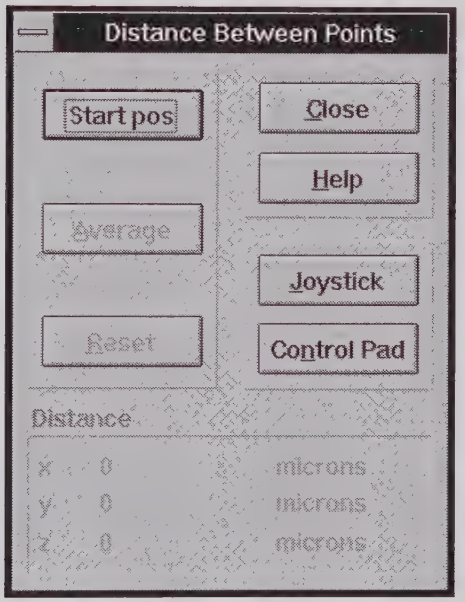
To Measure the Distance Between Two Points

Click the **Reset** *button to zero the distances.*

1. Choose **Distance** from the Get menu to open the Distance Between Points dialog box.
2. If not already running, click either the **Joystick** button or the **Control Pad** button, whichever you plan to use to move the stage.
3. Move the stage to the first location.
4. Click the **Start pos** button. The button changes to **End pos**.
5. Move the stage to the second location.
6. Click the **End pos** button. The dialog box displays the distance the stage moved along the x- and y-axes getting from the first point to the second.

Note

For probe stations with a motorized chuck, you can also measure the difference in height (z-axis distance) between the two points.



To Take the Average of Measurements

Click the **Reset** *button to zero the distances and start over collecting samples to average.*

1. Choose **Distance** from the Get menu to open the Distance Between Points dialog box.
2. If not already running, click either the **Joystick** button or the **Control Pad** button, whichever you plan to use to move the stage.
3. Move the stage to the first location.
4. Click the **Start pos** button. The button changes to **End pos**.
5. Move the stage to the second location.
6. Click the **End pos** button. The dialog box displays the distance the stage moved along the x- and y-axes getting from the first point to the second.
7. Repeat steps 3 through 6 until you have made the number of measurements that you want to average, up to 10.

Note

For probe stations with a motorized chuck, you can also measure and average the difference in height (z-axis distance) between the two points.

Click the **Average** button. The dialog box displays the average of the last measurement and all the previous measurements. You can average up to ten measurements.

Introduction

Probe plans files contain a symbolic map of your device-under-test (DUT) with sites marked for testing. Probe plans also define the alignment and origin die sites. Use the Probe Plan Editor (PPE) software to create and modify probe plans, and PCS to execute a probe plan.

To Edit a Probe Plan

PPE

Use the ProbePlan Editor (PPE) application to create or edit a probe plan file. You cannot edit the probe plan in the PCS wafer map display.

Refer to the ProbePlan Editor User Guide *and to PPE on-line help for more information.*

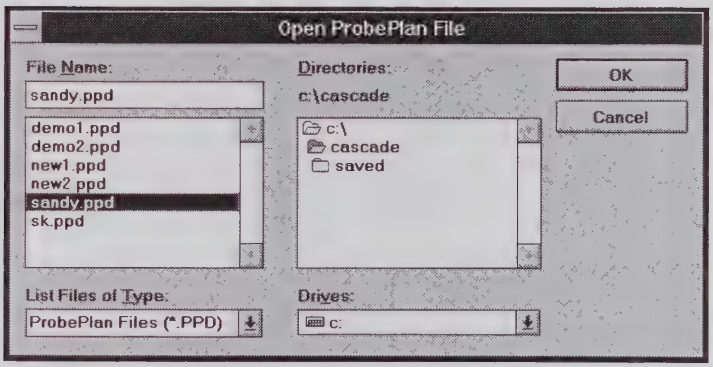
⇒ Choose **ProbePlan Editor** from the Launch menu.
-or-
Click the **PPE** button in the PCS window
-or-
Double-click the ProbePlan Editor icon in the Cascade menu group.

To Load a Probe Plan

1. Choose **ProbePlan moves** from the Move menu to display the ProbePlan dialog box.

Open

2. Click the **Open** button. PCS displays the Open ProbePlan File dialog box.
3. (Optional) Uncheck the **Display warnings** box if you want to bypass the series of stage-movement prompts that come up when a new probe plan is loaded. These prompts warn you that the stage is moving to the alignment die, the first die, etc.



Probe plan file names have the extension **.PPD**.

3. Select the drive, directory, and probe-plan file name.
4. Click **OK** to load the probe plan. The name of the probe plan appears in the title bar of the dialog box, and the screen displays a new window containing the wafer map.

To Unload a Probe Plan

Close

1. Choose **ProbePlan moves** from the Move menu to display the ProbePlan dialog box.
2. Click the **Close** button.. **Probe Plan: None** appears in the title bar indicating that no probe plan is loaded.

To View the Wafer Map

⇒ Click **Show map** in the ProbePlan dialog box. You can size the resulting Wafer Map window.

⇒ Check **Auto show map** in the ProbePlan dialog box to automatically display the wafer map whenever you open a probe plan.

Note

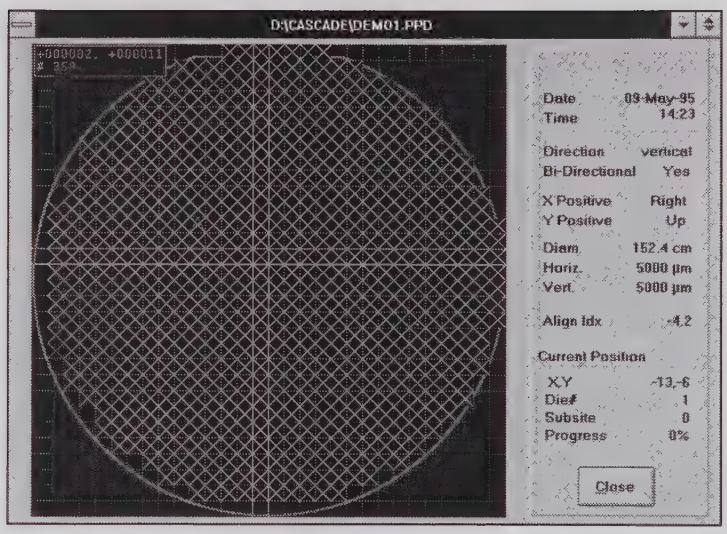
A large wafer-map window resembles the map created with the ProbePlan Editor; however, you cannot modify the PCS wafer map. Launch the Probe Plan Editor to modify a wafer map.

The wafer map uses the following conventions:

- An A marks the alignment die location.
- The vertical and horizontal graticules intersect at the origin.
- An X marks each test site. Bright Xs indicate sites not visited, while dim Xs indicate visited sites.
- Hold down the left mouse button to see the x- and y- coordinates when the Wafer Map is displayed in either medium or large window sizes.

The Probe Plan Wafer Map window has the standard Windows Control-menu box in the left corner of the title bar. This menu contains the following choices in addition to those normally found:

Choose	To Do This
Always on top	Displays the wafer map on top of any other window.
Always show coordinates	Displays the coordinates of the active die site (the cursor is on this site).
Small window Medium window Large window	Displays fixed-sized windows.



Executing a Probe Plan

To display the ProbePlan dialog box, choose **Probeplan moves** *from the* **Move** *menu.*

After you load a probe plan, you can execute the plan automatically, or you can single step through the plan. You can also choose to use a test program along with the probe plan.

Choose the desired ProbePlan dialog box options to specify how the probe plan executes.

.

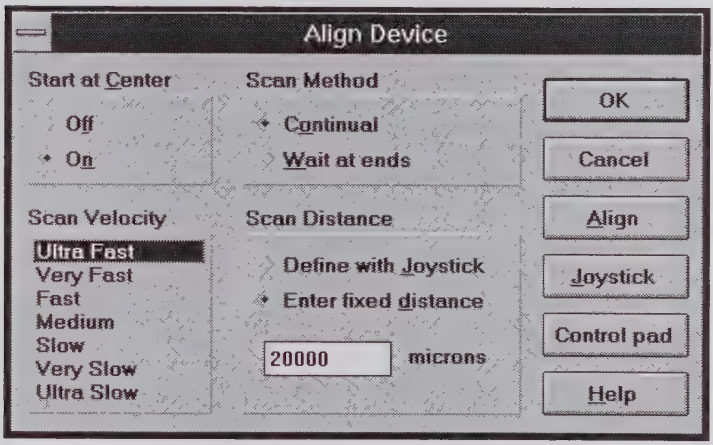
Aligning the DUT with the Wafer Map

Before executing the probe plan, you must adjust theta so that the alignment die on the DUT is aligned with the probe station's x- and y-axes. Then, you must align the probe-plan wafer map with the actual physical position of the DUT.

To Adjust Theta

1. Raise the platen.
2. Raise the chuck.

3. Select a feature on your DUT to use as a reference for alignment (or use the alignment die site in your probe plan). Move the stage so that you can see this feature through the microscope.
4. Choose **ProbePlan moves** from the Move menu to open the ProbePlan dialog box.
5. Click **Theta Align**. PCS displays the Align Device dialog box.
6. Under **Start at Center**, click either **On** or **Off**. If you select **On**, the stage always starts scanning from the center position. If **Off**, scanning starts from the current stage position.



7. Select either **Continual** or **Wait at ends** as the scan method. **Continual** causes the stage to move continually until you stop it by clicking **Cancel**. **Wait at ends** causes the stage to stop at each end of the scan distance until you click **Yes**.
8. Select the scan velocity.
9. Define the scan distance by entering a fixed distance

   --or--

   by defining the distance with the Joystick or Control Pad.

To Enter a Fixed Scan Distance

1. Click **Enter fixed distance**.
2. Enter the distance. The distance is measured in microns and is the distance between endpoints. The endpoints are equidistant from the start position.
3. Click **Align** to start scanning.

To define scan distance with the Joystick or Control Pad:

1. Click **Define with Joystick.**
2. Click either **Joystick** or **Control Pad**, whatever you prefer.
3. Click **Align.**

Follow the prompts to set the endpoints.

To Continue the Adjusting Theta

1. View the DUT through the microscope and turn the Theta Adjustment knob on your probe station until the DUT is correctly aligned.
2. When you are finished, click **Cancel** to stop scanning and close the dialog box.

To Align the DUT with the Wafer Map:

Be sure to adjust Theta before aligning the probe plan.

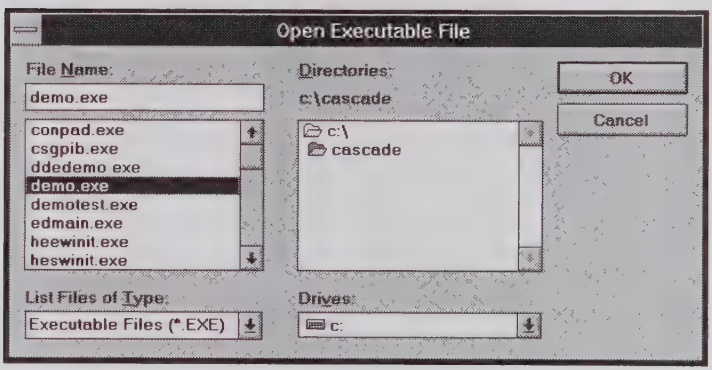
1. Raise the platen.
2. Raise the chuck.
3. Choose **ProbePlan moves** from the Move menu. PCS displays the Probe Plan dialog box.
4. Click **PP Align**. PCS displays the Move Align Position message box, which warns you that the stage is about to move to the alignment die location. (This message is not displayed if the **Display warnings** box is unchecked.)
5. Click **OK**. The stage moves to the alignment die location as specified by the wafer map, and the screen displays the Align Probes message box.
6. Using either the Control Pad or the Joystick, move the stage so that the probes are correctly positioned over the alignment die.
7. Click **OK**. PCS calculates the difference between the location of the wafer map's alignment die and its physical location. PCS will use this difference to ensure that probe-plan moves are accurate.
8. When PCS displays the Move First Site message box, click **OK.** The stage moves to the first site marked for testing in the probe plan.

To Run a Test Program with the Probe Plan

To automate testing, you create a test program to control the actions of the test equipment at each test site defined in the probe plan. Typically, the probes contact a test site, the test program executes a series of tests, the

probes move on to the next probe-plan test site, the test program executes again, and so on, until testing is complete.

1. Load a probe plan.
2. Click **Select** in the Probe Plan dialog box to display the Open Executable File dialog box.



3. Specify the test program pathname.
4. Click **OK**.
5. Execute the test program manually by clicking **Call Now**. The test program executes immediately.

   -or-

   Execute the test program automatically with the probe plan by checking the **Auto call** box.

To Visit Subsites

Subsites are test sites that the probe plan defines as offsets from each die site. If your probe plan defines subsites, you can choose whether or not to include them as test sites during the probe plan's execution. If you choose not to visit subsites, only main die sites are visited.

⇒ Check the **Subsites** box in the ProbePlan dialog box to visit subsites.

To Pause at Each Test Site

Normally, PCS moves immediately from one test site to the next without any delays. If desired, you can set a time for the probe station to pause at each test site before moving on to the next site.

⇒ Enter the number of milliseconds the probe station should delay in the Dwell field under Options in the Probe Plan dialog box.

To Automatically Execute a Probe Plan:

Start

1. Choose **ProbePlan moves** from the Move menu to display the Probe Plan dialog box.
2. Load a probeplan.
3. Click the **Start** button.

The probe station begins executing the probe plan at the first test site. The probes visit each site in turn until the probes reach the last test site, or until you stop the probe plan execution.

To Stop Executing a Probe Plan

Stop

⇒ Click the **Stop** button.

To Single Step Through a Probe Plan

By clicking the corresponding button, you can move to the following probe-plan test sites. Sites can be either die sites or subsites.

FIRST DIE SITE

LAST DIE SITE

PRIOR SITE

NEXT SITE

Glossary of Terms

Align

Process of getting the DUT oriented with respect to the probe station's coordinate system so that semi-automatic stage moves correctly place the probes. This can be done either by physically rotating the hardware (adjusting Theta) or by setting PCS software to compensate for misalignment.

Chuck

Wafer chuck. The part of a probe station on which you place your DUT. The chuck moves vertically to make or break contact between the probes and the DUT.

Command Interface

A Cascade Microtech programmatic interface that allows you to send probe-station control commands directly to the hardware drivers. Refer to the *Summit Series Probe Station Communications Guide* for more information.

Control Pad

A PCS software application that allows you to move the probe-station stage with the mouse. A virtual key pad consisting of 24 tiles appears on the screen. You move the stage by clicking on the tiles. You can modify the velocity corresponding to each tile.

DDE

Dynamic Data Exchange. A messaging system built into Windows that allows applications running in different windows to comunicate with each other. Refer to the *Summit Series Probe Station Communications Guide* for more information.

DUT

Device Under Test. The wafer, module, contact substrate, or ISS that you are probing.

Dwell When executing a probe plan, the time the probe station pauses at each test site before moving on to the next site. If a test program has been selected, the dwell time begins when the test program execution is complete.

GPIB

General Purpose Interface Bus. A communications protocol that allows instruments to communicate across a bus. Refer to IEEE 488.1-1987, IEEE 488.2-1987, and the *Summit Series Probe Station Communications Guide* for more information.

Hardware Align

Rotating the wafer chuck until the DUT axes are parallel to the probe-station axes (Theta = 0 degrees).

ISS

Impedance Standard Substrate. A wafer substrate containing die of known electrical characteristics that is used to calibrate a test system.

Joystick

A probe station accessory that allows you to move the stage by tilting a stick. To use the joystick, the Joystick software application must be running. You can modify the direction and velocity corresponding to various directions and angles of joystick tilt.

PCS

Prober Contol Software. Windows-based application software provided by Cascade Microtech to control semi-automatic probe stations.

Probe Plan

A file containing a symbolic map of your device-under-test (DUT) with sites marked for testing.

Probe Plan Align

Process of measuring the distance between the probe plan's coordinate for the DUT's alignment die and the actual physical position of the alignment

die. PCS uses the measurement to compensate for the discrepancy, correctly positioning the probes over each die site marked for testing.

Software Align

Process of measuring the discrepancy between the probe station's coordinate system and the actual physical position of the DUT. PCS uses the measurement to compensate for the discrepancy, correctly positioning the probes on the DUT during semi-automatic stage moves. An alternative to aligning the hardware by adjusting Theta.

Substite

Test sites on a DUT that are defined as offsets from a die site.

Stage

The movable platform that supports the wafer chuck. The stage moves left, right, forward, and backward.

Theta

Rotational angle between the probe-station's x-and y-axes and the DUT's x- and y-axes. Aligning Theta refers to rotating the wafer chuck until the DUT axes are parallel to the probe-station axes (Theta = 0 degrees).

Wafer map

A graphical representation of the DUT as described by the probe-plan file.

Index

A

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MP MASTER
MA32766